



“Stop writers from writing, in the span that
needs to be hidden from future.”

- Mrs. Om Lata Singh

**Hand Book
of
MICROCONTROLLERS
FOR
EMBEDDED SYSTEMS**

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PREFACE

जेहि विधि होई नाथ हित मोरा,
करो सुवेगि दास मह तोरा...

“Handbook of Microcontrollers for Embedded Systems” is an attempt to segregate the basics of microcontrollers starting with 8051 and introducing the MSP430x5xx microcontroller series which is latest from Texas Instruments. Texas gives a wide range of microcontroller platforms and based on applications, one can select among them like: MSP430 series, Tiva Series for practical purpose and G series for laboratory demonstrations in colleges. The various packages available can be used with the platforms like:

- (1) *CC100L Air module booster pack*
- (2) *TI Spin motors DRV8x Evaluation kit.*
- (3) *CC3200 Launch pad*
- (4) *MSP430eZ430-RF2500 Development tool.*
- (5) *Capacitive Touch booster pack*
- (6) *Sensor Hub booster pack with Wireless RFEM connections.*
- (7) *Tiva C Series TM4C123G Launch Pad.*
- (8) *TI's Simple Link CC3100 Booster Pack*
- (9) *C2200 Piccolo Launch Pad etc.*

This book is an attempt to give an start up with the Intel's 8051 and has many programming examples in assembly as well as C language which are simulated on Keil μ Vision 4 using Flash Magic for the kits available in laboratories of M.I.E.T., Meerut.

After the startup, there is a transition to the introduction of MSP430 from Texas Instruments. To give more insight of the same, the datasheets and user manuals have been referred. MSP430 has a rich set of registers to be programmed and therefore one might need the user manual hence every register and its related fields have been discussed. To spare students from referring huge datasheets and user manuals, several programs have been discussed along with registers and their respective fields that need to be programmed.

Alone microcontrollers can't do anything so various interfacing devices like ADC, DAC, stepper motor, external memories, LCD etc have been introduced with Intel's 8051 along with their interfacing and programming.

MSP430 family has various peripherals on boards, so the programming to access them is also discussed along with external interfacing using SPI, I2C and UART communication modules. Case study related to RFID and PIR sensors will give an insight on interfacing external peripherals.

From practical point of views two laboratory solved exercises have also been incorporated in the end along with a dedicated chapter for programming tips of C programming. Chapter 0 comprises of the introduction of software used for both Intel (Keil μ Vision 4 and Flash Magic) and Texas Microcontrollers (CCS, Teraterm and Energia).

Owing to increasing requirement to access entire sensor networks mainly WSN (Wireless Sensor Networks) through internet, last chapter is compiled to give a insight about IoT and its related WSN, connectivity and interfacings. At the end some sample questions have been incorporated to be practiced.

The compilers of the book recommend readers to refer Mazidi for Intel and John Davies for MSP430 basic information. This book is an effort to gather information available in datasheets, user manuals, books, and blogs etc. Kindly look out for the references for any additional information or you may write to us for any suggestions.

Also it is recommended that readers should refer to the latest edition of the book because there will be new case studies added in updated editions.

 *Mohini Preetam Singh*

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We would also like to thank **Dr. Mayank Garg**, Executive Director, M.I.E.T., Meerut and **Dr. (Professor) D. K. Sharma**, Dean Academics, M.I.E.T., Meerut for their constant support and guidance throughout the endeavors.

We would also like to thank our guides and faculties with whose blessings we are able to reach wherever we are today.

Last but not the least we would also like to thank our students for their constant curiosity that let us work even harder.

✍ Mohini Preetam Singh

✍ Vishal Verma

✍ Dr. Vivek Gupta

CONTENTS

CHAPTER ZERO.....	1
0.1. EMBEDDED SYSTEM	1
0.1.1. IMPORTANT FEATURES	1
0.1.2. BLOCK DIAGRAM OF AN EMBEDDED SYSTEM	1
0.1.3. BASIC BLOCKS OF EMBEDDED SYSTEM	2
0.2. EMBEDDED SYSTEMS TERMINOLOGIES	4
0.2.1. CISC VS RISC PROCESSOR TERMINOLOGY	4
0.2.2. BROWN-OUT RESET (BOR)	5
0.2.3. HARVARD AND VON- NEUMANN (PRINCETON) ARCHITECTURE	5
0.2.4. PIPELINING FOR VON-NEUMANN ARCHITECTURE	5
0.2.5. EXECUTING CODE IN ASSEMBLY AND C LANGUAGE	5
0.3. STEPS TO CREATE A PROGRAM IN ASSEMBLY LANGUAGE	6
0.4. TOOLS FOR EMBEDDED SYSTEM	7
0.5. USAGE OF KEIL (µVISION4) AND FLASH MAGIC SOFTWARE WITH 8 BIT MICROCONTROLLERS ...	7
0.5.1. KEIL (µVISION4)	7
0.5.2. FLASH MAGIC SOFTWARE	8
0.6. MSP430 SOFTWARE.....	8
 CHAPTER ONE	 9
1.1. MICROCONTROLLER VERSUS GENERAL-PURPOSE MICROPROCESSOR	9
1.1.1. EMBEDDED SYSTEMS	9
1.1.2. EMBEDDED PRODUCTS USING MICROCONTROLLERS	10
1.1.3. CRITERIA FOR CHOOSING A MICROCONTROLLER	10
1.1.4. OTP VERSIONS OF 8051.....	10
1.1.5. OVERVIEW OF 8051 FAMILY.....	10
1.2. MICROCONTROLLERS OF 8051 FAMILY FROM INTEL CORPORATIONS	10
1.3. VERSION OF 8051 FROM ATMEL (ALL ROM FLASH).....	11
1.4. VERSIONS OF 8051/8052 MICROCONTROLLER FROM DALLAS SEMICONDUCTOR (MAXIM CORP.)	11
1.5. VARIOUS SPEEDS OF 8051 FROM ATMEL	11
1.6. FEATURES OF 8051	12
1.7. PIN LAYOUT OF 8051	12
1.8. BLOCK DIAGRAM OF 8051 FAMILY MICROCONTROLLERS	13
1.9. BLOCK DIAGRAM OF 8051 CORE	13
1.10. INSIDE THE 8051/ REGISTER ORGANIZATION OF 8051	13
1.11. ADDRESS SPACE OF 8051	15
1.11.1. DATA TYPES	17
1.12. ASSEMBLER DIRECTIVES	17
1.13. 8051 INSTRUCTION SET	17
1.14. ADDRESSING MODES.....	19
1.15. BASICS OF ASSEMBLY PROGRAMMING	20
1.16. BASIC INSTRUCTIONS FOR ASSEMBLY LANGUAGE PROGRAMMING	21
1.17. EXAMPLES OF ASSEMBLY LANGUAGE PROGRAMMING	24
1.18. BASICS OF PROGRAMMING IN C.....	30
1.19. PROGRAMMING INTRODUCTION IN C	30
1.19. INTERFACINGS WITH 8051	41
1.19.1. LCD INTERFACING.....	41

1.19.2.	PIN CONFIGURATION OF 16X2 LCD OF 14 PINS	42
1.19.3.	COMMAND WORDS AND DATA WORDS FOR LCD	42
1.20.	ANALOG TO DIGITAL CONVERTER	45
1.20.1.	ADC0804.....	45
1.20.2.	INTERFACING OF ADC0804 WITH 8051	46
1.21.	DAC (DIGITAL TO ANALOG CONVERTER).....	47
1.21.1.	DAC0808.....	47
1.22.	STEPPER MOTOR	50
1.23.	MEMORY INTERFACING.....	52
1.23.1.	INTERFACING WITH EXTERNAL CODE/ PROGRAM MEMORY.....	52
1.23.2.	INTERFACING WITH EXTERNAL DATA MEMORY	52
1.24.	TIMERS AND COUNTERS	55
1.24.1.	TIMER OPERATION MODES	55
1.24.2.	TIMER REGISTERS	56
1.24.3.	TIMER PROGRAMMING.....	57
1.20.	REFERENCES	60

CHAPTER TWO61

2.1.	MSP430 FEATURES FOR LOW POWER AND PORTABLE APPLICATIONS	61
2.2.	NOMENCLATURE	61
2.3.	KEY-FEATURES.....	62
2.4.	ON-CHIP PERIPHERALS	62
2.5.	ARCHITECTURE OF MSP430F5XX	64
2.6.	MSP430 F5529 LAUNCH PAD	65
2.7.	ARCHITECTURE OF MSP430G2X53	65
2.8.	MSP430G2553 LAUNCH PAD	66
2.9.	BLOCK DIAGRAM OF MSP430X5XX.....	66
2.10.	BASIC BUILDING BLOCKS OF MSP430	66
2.11.	ADDRESS SPACE	71
2.11.1.	BOOTSTRAP LOADER	72
2.11.2.	DEVICE DESCRIPTOR TABLE	72
2.11.3.	INTERRUPT VECTORS.....	74
2.11.4.	REGISTER SET	74
2.12.	RELATED QUESTIONS.....	76

CHAPTER THREE77

3.1.	DIGITAL I/O INTRODUCTION	77
3.1.1.	DIGITAL I/O OPERATION.....	77
3.1.2.	EXAMPLE OF G SERIES LAUNCH PAD:.....	78
3.2.	MEMORY-MAPPED PERIPHERALS.....	79
3.3.	INTERRUPTS	79
3.3.1.	INTERRUPT PRIORITY.....	79
3.3.2.	PORT INTERRUPT SOFTWARE EXAMPLE	81
3.3.3.	INTERRUPT PROCESSING.....	81
3.3.4.	INTERRUPT ACCEPTANCE	81
3.3.5.	RETURN FROM INTERRUPT	83
3.3.6.	INTERRUPT NESTING	83
3.3.7.	INTERRUPT VECTORS.....	83
3.3.8.	ALTERNATE INTERRUPT VECTORS.....	84
3.3.9.	SYS INTERRUPT VECTOR GENERATORS	84
3.4.	OPERATING MODES (LOW POWER MODES)	84

3.5.	PULL-UPS AND PULL-DOWN REGISTERS.....	85
3.6.	GPIO AND INTERRUPT PROGRAMMING	86
3.7.	SAMPLE EMBEDDED SYSTEM ON MSP430 MICROCONTROLLER (RFID CASE STUDY).....	87

CHAPTER FOUR 92

4.1.	THE C PROGRAMMING BASICS	92
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CHAPTER FIVE 93

5.1.	PIN CONFIGURATION OF MSP430F5XX	93
5.2.	INSTRUCTION SET OF MSP430	97
5.2.1.	CLASSIFICATION OF INSTRUCTIONS CAN BE ON THE BASIS OF.....	97
5.2.2.	BASIC INSTRUCTION SET	98
5.2.3.	ASSEMBLY LANGUAGE INSTRUCTION FORMAT	100
5.3.	ADDRESSING MODES.....	100

CHAPTER SIX107

6.1.	WDT_A INTRODUCTION	107
6.1.1.	WDT_A OPERATION	107
6.1.2.	WDT_A REGISTER	107
6.1.3.	WATCHDOG TIMER MODES	108
6.1.4.	WATCHDOG TIMER INTERRUPTS	108
6.1.5.	SOFTWARE EXAMPLES	109
6.1.6.	WATCHDOG TIMER ISR FOR INTERRUPTS.....	109
6.1.7.	OPERATION IN LOW-POWER MODES.....	109
6.1.8.	CLOCK FAIL-SAFE FEATURE.....	109
6.2.	TIMER_A INTRODUCTION	109
6.2.1.	TIMER_A OPERATION.....	110
6.2.2.	STARTING THE TIMER.....	110
6.2.3.	TIMER MODE CONTROL	110
6.2.4.	CAPTURE/COMPARE BLOCKS	112
6.2.5.	OUTPUT MODES.....	112
6.2.6.	TIMER_A INTERRUPTS.....	114
6.2.7.	TAXIV, INTERRUPT VECTOR GENERATOR	114
6.2.8.	TAXIV SOFTWARE EXAMPLE.....	114
6.2.9.	TIMER_A REGISTERS.....	ERROR! BOOKMARK NOT DEFINED.
6.2.10.	TIMER_B INTRODUCTION.....	118
6.3.	MSP430F5529 DEMO TIMING GENERATION AND MEASUREMENT	119

CHAPTER SEVEN.....121

7.1.	UNIFIED CLOCK SYSTEM.....	121
7.1.1.	CLOCKS SIGNALS.....	121
7.1.2.	CLOCK SOURCES	122
7.1.3.	SYNCHRONIZATION OF CLOCK SIGNALS.....	123
7.1.4.	REGISTERS IN UNIFIED CLOCK SYSTEM	123
7.2.	ANALOG INTERFACING AND DATA ACQUISITION.....	125
7.2.1.	RESOLUTION V/S STEP SIZE FOR ADC.....	125
7.2.2.	ADC OPERATION.....	126
7.2.3.	ADC12_A REGISTERS	126
7.2.4.	ADC CONFIGURATION: KEY STEPS.....	132
7.3.	COMPARATOR : COMP_B	134
7.3.1.	COMPARATOR OPERATION	134

CHAPTER EIGHT 140

8.1.	DIRECT MEMORY ACCESS (DMA).....	140
8.1.1.	DMA ADDRESSING MODES.....	140
8.1.2.	DMA TRANSFER MODES.....	141
8.1.3.	INITIATING DMA TRANSFERS	141
8.1.4.	STOPPING DMA TRANSFERS.....	142
8.1.5.	DMA CHANNEL PRIORITIES	142
8.1.6.	HALTING EXECUTING INSTRUCTIONS FOR DMA TRANSFERS	142
8.1.7.	TRIGGERING CONDITIONS OF PERIPHERAL DEVICES TO START TRANSFER	142
8.1.8.	DMA TRANSFER CYCLE TIME	143
8.1.9.	USING DMA WITH SYSTEM INTERRUPTS.....	143
8.1.10.	DMA CONTROLLER INTERRUPTS	143
8.1.11.	TYPES OF REGISTERS IN DMA	143
8.2.	REAL TIME CLOCK	148
8.2.1.	RTC MODES	148
8.2.2.	REAL-TIME CLOCK AND PRESCALE DIVIDERS.....	148
8.2.3.	REAL-TIME CLOCK ALARM FUNCTION	148
8.2.4.	READING OR WRITING REAL-TIME CLOCK REGISTERS IN CALENDAR MODE	149
8.2.5.	REAL-TIME CLOCK INTERRUPTS.....	149
8.2.6.	REGISTERS	150

CHAPTER NINE 155

9.1.	BASICS OF SERIAL COMMUNICATION	155
9.1.1.	SYNCHRONOUS AND ASYNCHRONOUS COMMUNICATION.....	155
9.1.2.	BIT RATE COMPARISON	156
9.1.3.	SERIAL PORT STANDARDS	156
9.1.4.	SERIAL PORT INTERFACE PINOUT AND SIGNALS	157
9.1.5.	PORT PINS MAY HAVE NO CONSTANT MEANING	157
9.1.6.	HOW TO CONNECT RS232 PORTS USING CABLES	157
9.2.	MSP430 COMMUNICATIONS	158
9.2.1.	UNIVERSAL SERIAL COMMUNICATION INTERFACE	158
9.3.	UART MODE (UNIVERSAL ASYNCHRONOUS RECEIVER TRANSMITTER).....	159
9.3.1.	FORMAT OF DATA FOR ASYNCHRONOUS TRANSMISSION	159
9.3.2.	PROTOCOL DESCRIPTION	159
9.3.4.	INITIALIZING OR RECONFIGURING THE USCI MODULE	161
9.3.5.	MULTIPROCESSOR FORMAT.....	161
9.3.6.	FORMATS.....	161
9.3.7.	DMA OPERATION	163
9.3.8.	UART BAUD-RATE GENERATION	163
9.3.9.	REGISTERS	164
9.3.10.	IMPLEMENTING, PROGRAMMING AND INTERFACING UART WITH MSP430	170
9.3.11.	REGISTERS REQUIRED FOR UART	171
9.3.12.	CONFIGURING THE BAUD RATE	171
9.3.13.	INTERRUPTS OF MSP430 UART	172
9.4.	SPI (SERIAL PERIPHERAL INTERFACE)	176
9.4.1.	PHYSICAL INTERFACE.....	176
9.4.2.	USCI OPERATION – SPI MODE	177
9.4.3.	SPI ENABLE	177
9.4.4.	WORKING	178
9.4.5.	REGISTERS	178
9.4.6.	CONFIGURING THE MSP430 FOR SPI.....	181
9.4.7.	CONFIGURING MSP430F5529 PINS FOR SPI.....	182
9.4.8.	EXTERNAL INTERFACING	183
9.5.	I2C (INTER INTEGRATED CIRCUIT)	185

9.5.1.	USCI OPERATION – I2C MODE	185
9.5.2.	USCI INITIALIZATION AND RESET.....	186
9.5.3.	I2C SERIAL DATA.....	186
9.5.4.	I2C ADDRESSING MODES	187
9.5.5.	I2C MODULE OPERATING MODES.....	187
9.5.6.	ARBITRATION	189
9.5.7.	I2C CLOCK GENERATION AND SYNCHRONIZATION	189
9.5.8.	REGISTERS	190
9.5.9.	PROGRAM FOR TRANSMISSION AND RECEIVING OF BYTES USING I2C	195
CHAPTER TEN		197
10.1.	OVERVIEW OF INTERNET OF THINGS	198
10.1.1.	DEVICES	198
10.1.2.	GATEWAY	200
10.1.3.	CLOUD PLATFORM	201
10.2.	WIRELESS SENSOR NETWORKS	202
10.2.1.	OVERVIEW	202
10.2.2.	POTENTIAL APPLICATIONS	202
10.2.3.	WSN TOPOLOGIES	203
10.2.4.	COMPONENTS OF A WSN NODE	203
10.2.5.	WSN DESIGN EXAMPLES	203
10.2.6.	WIRELESS CONNECTIVITY/PROTOCOLS.....	205
10.2.7.	COMMUNICATION PROTOCOLS	205
10.2.8.	TO IP OR NOT TO IP	206
10.2.9.	NETWORK TOPOLOGY AND SIZE	207
10.2.10.	WIRELESS AND RADIO FREQUENCY TECHNOLOGIES	208
10.3.	STANDARDS AND INTEROPERABILITY	208
10.4.	EMBEDDED WIFI.....	213
10.5.	ADDING WI-FI TO MICROCONTROLLER.....	215
10.5.1.	THE SIMPLELINK HOST DRIVER IS RESPONSIBLE	216
10.6.	USER INTERFACE NETWORK AND WIRELESS API	216
10.7.	HTTP SERVER API.....	218
10.7.1.	USING HTTP SERVER API	218
10.7.2.	THE FUTURE OF APIS	219
10.7.3.	APIS FOR TEXAS SIMPLELINK FAMILY ARE MEANT FOR IOT APPLICATIONS	219
10.7.4.	DESIGN: BUILDING IOT APPLICATIONS USING CC3100 USER API FOR CONNECTING SENSORS.	220
APPENDIX 1A		
MICROCONTROLLERS FOR EMBEDDED SYSTEMS LAB (NEC-655)		224
EXPERIMENT 1		224
EXPERIMENT 2		224
EXPERIMENT 3		225
EXPERIMENT 4		226
EXPERIMENT 5		227
EXPERIMENT 6(A).....		228
EXPERIMENT 6(B).....		228
EXPERIMENT 7		229
EXPERIMENT 8		229
EXPERIMENT 9		230
EXPERIMENT 10		231

APPENDIX 1B	
MICROPROCESSORS AND MICROCONTROLLERS LAB (REC451).....	234
1. OBJECTIVE 1	234
2. OBJECTIVE 2	234
3. OBJECTIVE 3	235
4. OBJECTIVE 4	237
5. OBJECTIVE 5	238
6. OBJECTIVE 6	238
7. OBJECTIVE 7	239
8. OBJECTIVE 8	240
9. OBJECTIVE 9	242
10. OBJECTIVE 10	245
 APPENDIX 2	
QUESTION BANK.....	247
 APPENDIX 3	
AKTU UNIVERSITY QUESTION PAPER 2016-17	
MICROCONTROLLERS FOR EMBEDDED SYSTEMS.....	250

LIST OF FIGURES

0.1:	Block diagram of an Embedded System	3
0.2:	Five Cycle Pipelining.....	4
0.3:	Harvard Architecture	5
0.4:	Von Neumann / Princeton Architecture.....	5
0.5:	Steps to create program in Assembly Language	6
1:	a) General Purpose Microprocessor System.....	9
1:	b) Microcontroller	9
1.1:	Microcontroller based Embedded System and Microprocessor based Embedded System	9
1.2:	Pin Diagram of 8051	12
1.3:	Block Diagram of 8051 family microcontrollers.....	13
1.4:	Block Diagram of 8051 core	13
1.5:	Register Banks.....	14
1.6:	PSW/Flag Register.....	15
1.7:	Internal RAM Address Space.....	16
1.8:	Instruction Format	18
1.9:	Extended ASCII Table	21
1.10:	Data Acquisition and Conditioning Flow.....	41
1.11:	LCD Display Configuration.....	42
1.12:	Graphical LCD	43
1.13:	Character LCD display.....	43
1.14:	LCD Interfacing with 8051	44
1.15:	ADC Interfacing with 8051 [0]	46
1.16:	Read and write timing of ADC signals [0]	47
1.17:	DAC interfacing with 8051 [0].....	47
1.18:	Staircase and Triangular Waveform	48
1.19:	Stepper motor interfacing with 8051 [0].....	50
1.20:	Program memory interfacing [0]	52
1.21:	Data Memory interfacing [0].....	53
1.22:	256KB Interfacing with 8051.....	54
1.23:	Interfacing of Data RAM, Data ROM and Program ROM with 8051	54
1.24:	T0 and T1 structure	55
1.25:	TMOD Configuration.....	56
1.26:	TCON register configuration	56
1.27:	Steps of Count Updation.....	57
1.28:	Example 1.....	57
1.29:	Ex5 waveform.....	59
2.1:	Architecture of MSP430F5529.....	64
2.2:	Launch Pad MSP430F5529	64
2.3:	Architecture of MSP4302553 G2 series.....	65
2.4:	Launch Pad G2 Series (MSP430G2553).....	66
2.5:	Block Diagram of MSP430x5xxx	66
2.6:	Address Space for MSP430 x5xx Series.....	72
2.7:	Register Organization	74

2.8:	Program Counter Structure	75
2.9:	Status Register	75
3.1:	Interrupts structure in MSP430.....	79
3.2:	Interrupts Programming in Assembly	82
3.3:	Stack structure	83
3.4:	Return from Interrupt.....	83
3.5a:	Pull up Resistors.....	86
3.5b:	Pull down Resistors	86
3.6:	Interfacing between MSP430F2274 and TMS37157 PaLFI.....	88
3.7:	Interfacing between MSP430F2274 and SHT21.....	89
3.8:	Changes in PaLFI to interface with Wireless sensor	89
3.9:	Initialization of SPI and I2C	90
3.10:	Busy ISR (Interrupt Service Routine).....	91
5.1:	Launchpad MSP430F5529 Pinout [1]	96
5.2:	Instruction Set of MSP430F5529	98
6.1:	Up mode Waveform	110
6.2:	Continuous Mode Waveform	111
6.3:	Up/ Down Waveform	111
6.4:	Shows EQU2, EQU1 and EQU0.....	112
6.5:	Output Mode Waveform.....	113
6.6:	Interrupt Handler for TA0IFG, TA0CCR6 CCIFG and TA0CCR5 CCIFG.....	115
7.1:	General Block Diagram of Clock Module of MSP430.....	122
7.2:	Timing diagram of Clocks.....	123
7.3:	Clocks used by different Peripherals.....	123
7.4:	Block diagram of Comparator.....	134
7.5:	Reference Voltage Generator	135
7.6:	Block diagram of Reference Voltage Generator	136
7.7:	Application of Comparator.....	136
7.8:	Timings of Temperature Measurement.....	137
8.1:	Transfer modes.....	140
8.2:	RTC clocks.....	148
9.1:	Serial Communication.....	155
9.2:	Parallel communication	155
9.2.1.:	RS232 Pinouts	157
9.2.2.:	DB9 Male and female connectors.....	158
9.3:	Receiving a frame in a UART	160
9.4:	Two asynchronous bytes to that carry data 0x55 and 0Xff. Each frame is delimited by a start bit (ST) and stop bit (SP)	160
9.5:	Multiprocessor Format.....	161
9.6:	Data frame of a Synchronization Sequence.....	162
9.7:	format for Infrared Transmission.....	163
9.8:	USCI_A0 in UART mode [2]	170
9.9:	BRCLK with Baud Rate [2]	172
9.9a:	External Interfacing or Interfacing MSP430 UART with the Real World	174
9.9b:	RS232 Role in communication through UART.....	174
9.10:	Interfacing MSP430 UART	174

9.11:	Check COM port number under Device Manager	175
9.12:	RXD and TXD pins in the Hardware UART mode.....	175
9.13:	Put the COM port number and select the baudrate on PuTTY terminal program	175
9.14:	character 'A' is displayed on the PuTTY terminal	176
9.15:	SPI connection between a Master and a Slave device.....	176
9.16:	A SPI connection between a Master and number of Slave Devices	177
9.17:	Configuration of the Polarity (POL) and Phase (PH) bitsin the MSP430 SPI modules.....	178
9.18:	External Interfacing in Master Mode	183
9.19:	External Interfacing in Slave Mode.....	184
9.20:	USCI module through the 2-wire I2C interface	185
9.21:	The I2C mode supports any Slave or Master.....	186
9.22:	Timing diagram of I2C	186
9.23:	Transition of SDA with SCL.....	187
9.24:	7-Bit Addressing.....	187
9.25:	10-Bit Addressing.....	187
9.26:	Repeated Start Conditions.....	187
9.27:	I2C Slave Transmitter Mode	188
9.28:	I2C Slave Receiver Mode.....	188
9.29:	I2C Master Transmitter Mode	188
9.30:	I2C Master Receiver Mode	189
9.31:	An arbitration procedure if two or more master transmitters simultaneously start transmission	189
10.1:	Architecture of IoT	197
10.2:	Hierarchy of IoT Structure	198
10.3:	Three Basic Components of System	198
10.4:	Various stages of IoT data management in Cloud Platform.....	201
10.5:	Three types of WSN Topologies.....	203
10.6:	Technical components of WSN node	203
10.7:	Wireless Motion Detector block Diagram.....	204
10.8:	PIR Motion Sensor Construction	204
10.9:	Frequency bands of worldwide regulations Radio Transmissions.....	205
10.10:	A 4-layer simplified version of the model of Data Communication	205
10.11:	Wireless LANs (WLANs)	207
10.12:	Wireless Networks Topologies	207
10.13:	Comparison of different parameters of Wireless and Radio Frequency Technologies	213
10.14:	Embedded Wifi.....	214
10.15:	Connections of CC3000 with MCU	215
10.16:	HTTP a client/server protocol.....	217
10.17:	Simple link HTTP Web Server	218
10.18:	APIs for Texas Simplelink Family.....	219
10.19:	Design: IoT Application	223
LA.1:	Square Wave Display	225
LA.2:	Ramp Waveform.....	228
LA.3:	PWM Generation	230

LA.4:	Serial Monitor Display	233
LA.5:	Webpage on CC3100 Server	233
LB.1:	MSP430G series Launch Pad.....	234
LB.2:	Potentiometer connection.....	239
LB.3:	Motor connection.....	239
LB.4:	UART connection	240
LB.5:	Terminal settings	241
LB.6:	UART Display.....	242
LB.7:	Synchronous SPI mode of USCI.....	242
LB.8:	Functional block diagram.....	243
LB.9:	Master-slave communication using SPI.....	243
LB.10:	Debug Messages on Terminal window for connection to LAN	246

LIST OF TABLES

1.1:	Embedded Products using Microcontroller.....	10
1.2:	Microcontrollers versions of 8051 family from Intel Corporations	10
1.3:	Microcontrollers versions of 8051 family from Atmel.....	11
1.4:	Microcontroller versions of 8051 family from Dallas Semiconductor (Maxim Corp.).....	11
1.5:	Speeds of 8051 from Atmel.....	11
1.6:	SFR Registers	14
1.7:	Register Bank Selection.....	15
1.8:	Basic Instructions of 8051.....	21
1.9	LCD Pin Configuration.....	42
1.10	Common Commands.....	43
1.11	Step Size	45
1.12:	Signals of ADC 0804.....	45
1.13:	Step size for $V_{ref} / 2$ (V)	45
1.14:	Sine waveform values [0]	49
1.15:	Step angle and steps per resolution	51
1.16:	Winding Supply Patterns	51
1.17:	Accessing memory map above maximum limit of 64KB	53
1.18:	Address selection lines for Memory ICs	54
1.19:	Memory map of ICs	55
1.20:	Timers Modes.....	56
2.1:	JTAG signals.....	67
2.2:	Spy-Bi-Wire Signals.....	67
2.3:	Device Descriptor Table.....	73
2.4:	Peripheral Ids	73
2.5:	Values of Constant Generators CG1 and CG2.....	75
2.6:	SFR Registers	76
3.1:	Interrupt Vectors	83
3.2:	Low power modes in MSP430	85
5.1:	Pin Configuration of MSP430F5529.....	93
5.2:	Instruction Set of MSP430F5529	98
5.3:	Addressing Modes of MSP4305xx series.....	100
6.1:	Timer Mode Control.....	110
6.2:	OUTMODx modes.....	113
7.1:	Clock Modules in MSP430 Device Family	121
7.2:	Clock Signals in MSP430	121
7.3:	Fault Conditions	123
7.4:	Step size	125
7.5:	ADC Channels Selection.....	133
8.1:	Transfer modes of DMA.....	141
8.2:	DMA Operations with Peripherals.....	142
9.1:	Bit Rate Comparison.....	156
10.1:	Wi-fi Standards	213

